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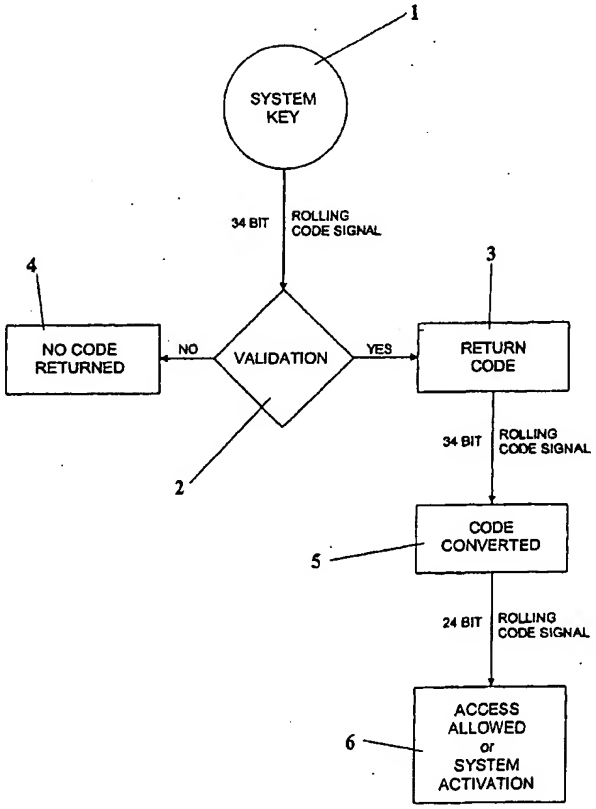
[Continued on next page]

(54) Title: ACCESS CONTROL SYSTEM



(57) Abstract: An access control system having a capability to validate a coded data string wireless transmission using a code hopping or rolling code algorithm and, if the transmission is validated, causing and/or allowing a function to occur responsive to receipt of another code string.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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ACCESS CONTROL SYSTEM

Technical Field

The present invention relates to coded entry or access and more particularly access control, security or entry of data logging that involves the validation of a data string.

Background Art

There are many instances where coded entry or access is required. Examples include door and gate systems but such examples are not exhaustive.

For example, with doors or garages it is common to utilise a wireless transmission (e.g. radio, infrared, microwave, etc.) to be detected by a receiver which either validates or does not validate the instruction and consequently respectively actuates or does not actuate.

The present invention recognises an advantage in having for coded entry and/or access purposes means of wirelessly transmitting a coded transmission (e.g. data string) that will vary each time it is used but not to the confusion of its dedicated receiver and only after such verification proceeding through (by any relay means, wired or wireless) to and/or enabling an ancillary data encryption format which has the capability of allowing or causing an action being instructed by and/or substantially together with the original transmission.

It is therefore to such systems that the present invention is directed, on at least to provide the public with a useful choice.

Disclosure of Invention

Accordingly in a first aspect the present invention consists in **an access control system** having a capability to validate a coded data string wireless transmission using a code hopping or rolling code algorithm and, if the transmission is validated, causing and/or allowing a function to occur responsive to receipt of another code string.

In a further aspect the present invention consists in **an access control system** that has, in sequence two code recognitions systems, the first to recognise a wireless

transmission of a data string and the second to be responsive to a related and/or unrelated data string only upon a validated receipt of the first mentioned data string,

wherein the first code recognition system is of a rolling or code hopping type so as to render wireless recording thereof by an authorised person unhelpful without access to the rolling or hoping algorithm.

Preferably the function control data string is shorter than that initially wirelessly transmitted.

In another aspect the invention consists in **an access control system**

having access function(s) controlled by a coded protocol ("function control protocol") system,

and having a coded protocol reliant on wireless transmission and receipt thereof ("the verification protocol") which code hops or rolls reliant on a relating algorithm,

wherein verification by the verification protocol is a prerequisite for access function(s) under the control of the function control protocol being allowed.

Preferably the function control protocol involves fewer coded bits than the verification protocol.

Preferably several transmitters can be verified to enable at least some control of the function control protocol.

Preferably the function(s) include door opening/closing.

Optionally verification protocol can be the or a Wiegand protocol.

Optionally function control protocol can be the or a KEELOQ™ protocol.

The present invention consists in apparatus of a system in accordance with the present invention.

The present invention relates to **methods** of operating an access control which is reliant upon a system in accordance with the present invention.

In still a further aspect the present invention consists in the use of apparatus to transmit verification data and/or instruction data as part of the system of the present invention or as part of the method of the present invention.

In still a further aspect the present invention consists in a door or other access opening responsive to control of the kind contemplated by the present invention.

As used herein the term "and/or" means "and" or "or", or both where the circumstances allow.

As used herein the term "(s)" following a noun means both or either the plural and singular forms of that noun.

As used herein the term "/" between nouns (e.g. as used hereinafter as "opening/closing" means both the opening and closing functions or either.

Reference herein to the Wiegand protocol refers to a standard data output format that is an industry standard digital protocol for accessing and transferring data between devices (see published standard of The Security Industry Association of the USA).

Reference herein to a KEELOQ™ protocol refers to a code hopping technology developed specifically for secure remote keyless entry and authentication based on the principle is that the code changes (hops) each time it is transmitted. KEELOQ™ is based on a proprietary, non-linear encryption algorithm that creates a unique transmission on every use, rendering code capture and resend schemes useless. The algorithm uses a programmable 64-bit encryption key unique to each device to generate 32-bit hopping code.

Reference to a protocol that is "or the like" by reference to the Wiegand protocol or the KEELOQ™ protocol means that protocol embodied in Microchip KEELOQ™ products of Microchip technology Incorporated. Reference is made to their website < http://www.microchip.com/1010/index.htm>.

For the purpose of the use of systems of the present invention in garage door openings reference is drawn to the website of *www.merlingo.com/* as demonstrating apparatus and forms appropriate for such control.

Brief Description of Drawings

A preferred form of the present invention will now be described by reference to the two flow diagrams of which

Figure 1 shows a diagram where a data string wirelessly transmitted is detected and verified or not and it is only upon verification that that data string continues into a different coded protocol to effect functions,

Figure 2 shows an alternative where simultaneous or substantially simultaneous transmissions ensure verification prior to allowing a separately transmitted data string to activate the different protocol,

Figure 3 shows a further alternative embodiment whereby a wireless rolling code signal is sent to a receiver which upon positive validation outputs a converted code of a differing rolling code format the signal whether being transmitted in a wired or wireless format then allows access or activates the system, and

Figure 4 is a diagram for use in our explanation of some functions and logic features of a preferred implementation of the present invention.

Best Mode for Carrying Out the Invention

Systems in accordance with the present invention preferably link systems such as that marketed under the trade marks Wiegand and KEELOQ™ so as to provide for the access control system the synergism of initiation to less secure input data strings only upon recognition of a more secure data string protocol. Such a system will enable more transmitters to be made available without any substantial undermining of security. In, for example, a garage door opening scenario or a gate opening scenario, related functions to initiation can be compounded in the scenario of Figure 1 where, for example the code string of the verification protocol may be say of 34 bits whilst that of the function control protocol may be less than half that.

With reference to Figures 1 through 3 is shown varying embodiments of an access control system. The system converts data transmitted wirelessly, for example from a radio transmitter, keypad, or similar 1, in an encrypted code utilising a rolling or code hopping algorithm (such as KEELOQ™). The data is received and validated by a receiver 2 using the appropriate decryption algorithm and then a signal relayed by any means, wired or wireless, in another data encryption format (such as Wiegand) to another access control, security, entry or data logging system 6 for validation and recording by that system such validation may allow activation of a latch or similar means to then allow access by the user or person who originally transmitted the signal. The system also allows for the receiver to learn and store a number of remote

transmitted devices 1. In this way multiple users can gain access with their own code to the system.

The system key 1 sends out a 34 bit rolling code signal, such as that generated by the KEELOQ™ security protocol, this is then received by a receiver 2 which then validates this signal. If the signal is not validated no code is returned 4. If the validation is positive then an output is generated. In the situation where there is a further receiver 5 such as in Figure 1 this receives the code output from 3 as a 34 bit rolling code signal (whether wired or wireless signal). The second receiver 5 then converts the information from the 34 bit rolling code signal and outputs this as a 24 bit rolling code signal (such as that generated by the Wiegand protocol) which then gives the user access or activates the system.

In a situation where the return code is sent to the original system key 1 then this return 34 bit rolling code signal is received and then converted to a 24 bit rolling code signal by 5 which is transmitted to then activate the system or allow access to the system.

A further embodiment allows, upon a positive validation from the receiver 2 generation directly of a 24 bit rolling code system by a conventer 7 which is transmitted either by wired or wireless means to allow further access 6.

In this way a high security protocol such as that provided by a 32 bit rolling code system will allow the user upon positive validation of the user, access to or activation of a further system, the activation of or access to that system occurring via a lower security protocol such as a 24 bit rolling code signal. This two layer security system providing a more secure system.

A description of the function and some underlying logic of the door controller limit system in one preferred or optional embodiment will now be described. It may use hardware as disclosed in our New Zealand Patent Specifications 522578 or 522300 filed 12 November 2002 and 25 October 2002 respectively, or indeed any mounting, assembly, subassembly and system we have disclosed by way of publication or use in respect of our MERLIN™ brand door systems.

Operation before setup

The manual control button ideally requires to be continuously depressed to move the door. Successive presses result in reversal of door travel direction. This ensures that the door can not accidentally be moved beyond the correct physical end-points of travel.

Set up

To define the limit positions the following process should be performed:

- move the door to the desired open or closed limit position
- store that position in memory
- move the door to the other desired limit position
- store that position in memory

Operation after setup

A brief press of the manual control button will move the door from one limit to the other. Pressing the manual control button while the door is moving stops the door.

Controller overview

The following controller inputs, outputs, and parameters are relevant:

- the state of the reference switch: either 0 or 1
- the state of the motor control relays: opening, closing, or stopped
- the state changes of the position sensor: 0 or 1 for every k mm of door position (where k is a constant dependent on gearing, and type of sensor)
- time
- motor current

From these the controller can infer the position, speed and direction of the door's travel. With knowledge of the motor's torque-speed, and torque-current, characteristics the load placed on the motor can be inferred for any position of the door's travel.

If the controller has been reset, it can not determine whether its stored relative position is correct so it must recalibrate to the reference position. In order to decide which direction to travel first it checks the state of the reference switch and then moves towards the reference point. Once the reference switch has changed state,

normal operation resumes. The user will be unaware of this unless they stop the door and try to move the door in the opposite direction before the reference switch changes state. In this circumstance the user will be required to continuously depress the manual control button.

On every uninterrupted operation from a limit position the counter will be set to zero at the reference switch. The counter values for the open and closed limits will be referenced to the newly calibrated reference position. See Figure 8.

Adaptive travel adjustment

The motor speed and/or current is stored with door position during setup. If during normal operation within a short distance of the bottom limit the speed and/or current does not match the stored values within some percentage then the physical limit position is judged to have been altered. The new limit position replaces the old limit position counter value.

CLAIMS:

1. **An access control system** having a capability to validate a coded data string wireless transmission using a code hopping or rolling code algorithm and, if the transmission is validated, causing and/or allowing a function to occur responsive to receipt of another code string.

2. A system of claim 1 wherein the function control data string is shorter than that initially wirelessly transmitted.

3. **An access control system** that has, in sequence two code recognitions systems, the first to recognise a wireless transmission of a data string and the second to be responsive to a related and/or unrelated data string only upon a validated receipt of the first mentioned data string,

wherein the first code recognition system is of a rolling or code hopping type so as to render wireless recording thereof by an authorised person unhelpful without access to the rolling or hoping algorithm.

4. **An access control system**

having access function(s) controlled by a coded protocol ("function control protocol") system,

and having a coded protocol reliant on wireless transmission and receipt thereof ("the verification protocol") which code hops or rolls reliant on a relating algorithm,

wherein verification by the verification protocol is a prerequisite for access function(s) under the control of the function control protocol being allowed.

5. A system of claim 4 wherein the function control protocol involves fewer coded bits than the verification protocol.

6. A system of claim 4 or 5 wherein several transmitters can be verified to enable at least some control of the function control protocol.

7. A system of any one of claims 4 to 6 wherein the function(s) include door opening/closing.

8. A system of any one of claims 4 to 7 wherein verification protocol can be the or a Wiegand or like protocol.

9. A system of any one of claims 4 to 8 wherein the function control protocol is a KEELOQ™ or like protocol.

10. Apparatus incorporating a system in accordance with any one of the preceding claims.

11. **Methods** of operating an access control which is reliant upon a system in accordance with any one of claims 1 to 9.

12. The use of apparatus to transmit verification data and/or instruction data as part of a system of any one of claims 1 to 9 or as part of the method of claim 11.

13. A door or other access opening obstruction responsive to control of a system of any one of claims 1 to 9.

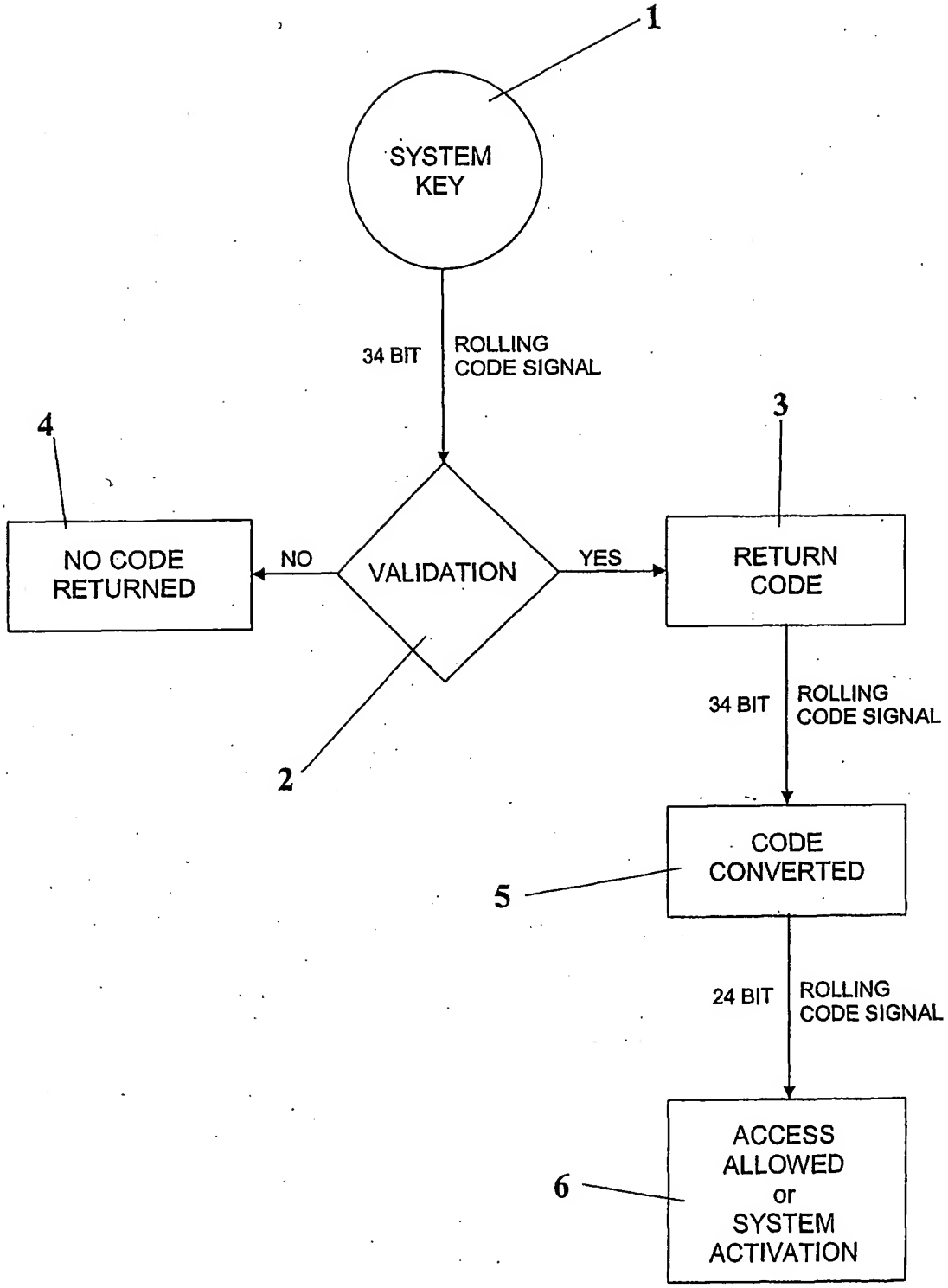
1
SYSTEM KEY
34 BIT
ROLLING CODE SIGNAL
4
3
NO CODE RETURNED
NO
VALIDATION
YES
RETURN CODE
34 BIT
ROLLING CODE SIGNAL
2
CODE CONVERTED
5
24 BIT
ROLLING CODE SIGNAL
ACCESS ALLOWED or SYSTEM ACTIVATION
6

FIGURE 1

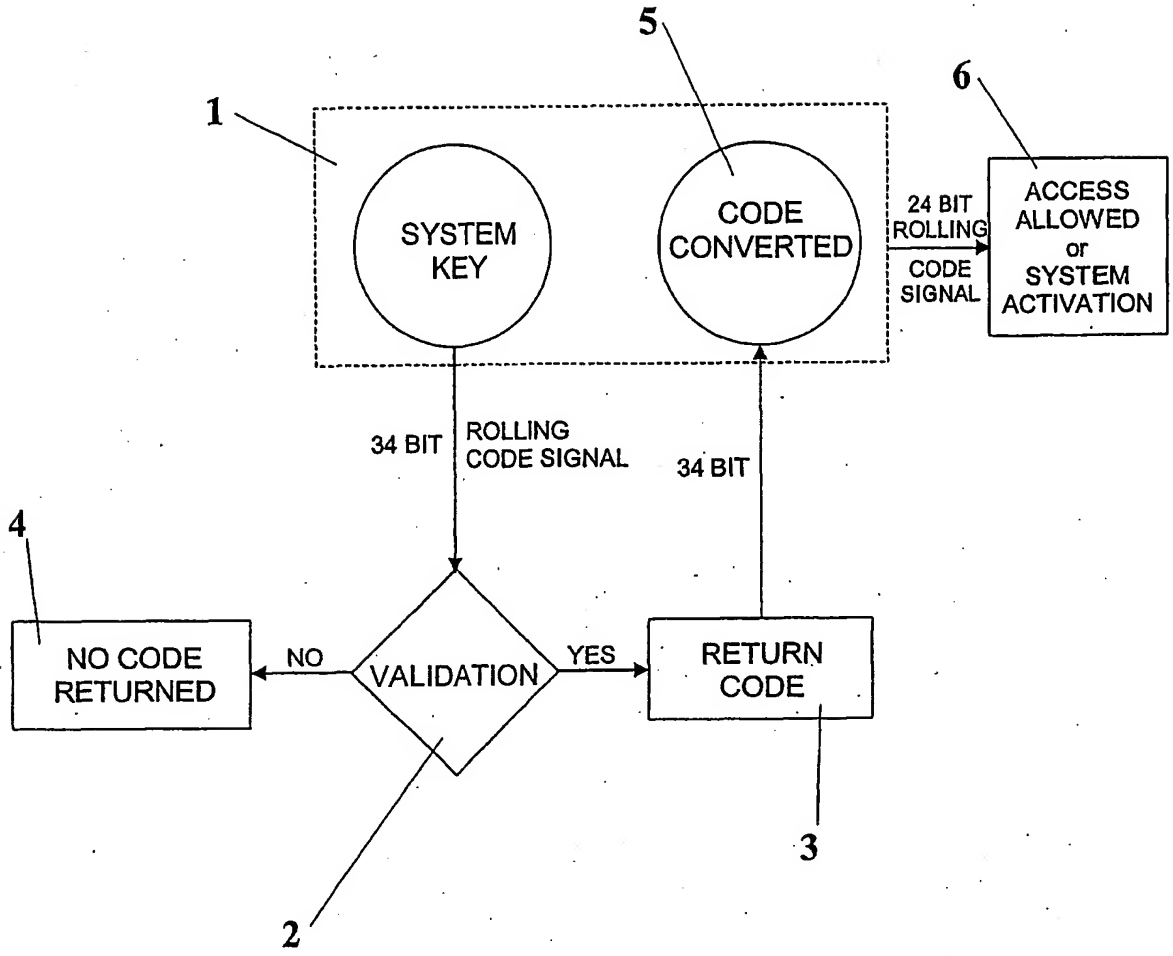
5
6
1
SYSTEM KEY
CODE CONVERTED
24 BIT ROLLING CODE SIGNAL
ACCESS ALLOWED or SYSTEM ACTIVATION
34 BIT ROLLING CODE SIGNAL
34 BIT
4
NO CODE RETURNED
NO
VALIDATION
YES
RETURN CODE
2
3

FIGURE 2

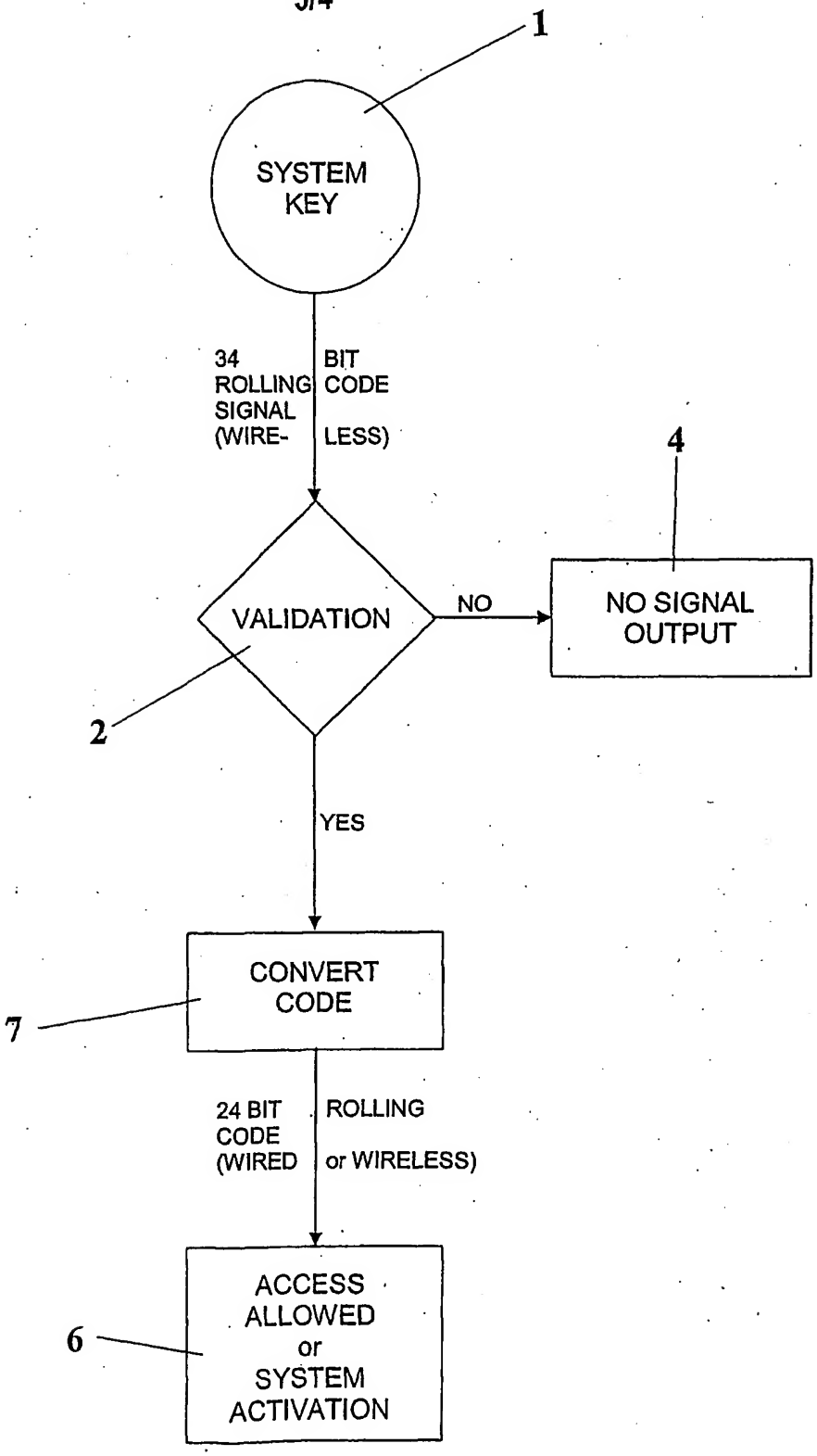
1
SYSTEM KEY
34 ROLLING SIGNAL (WIRE-
BIT CODE
LESS)
4
VALIDATION
NO
NO SIGNAL OUTPUT
2
YES
CONVERT CODE
7
24 BIT CODE (WIRED
ROLLING
or WIRELESS)
ACCESS ALLOWED or SYSTEM ACTIVATION
6

FIGURE 3

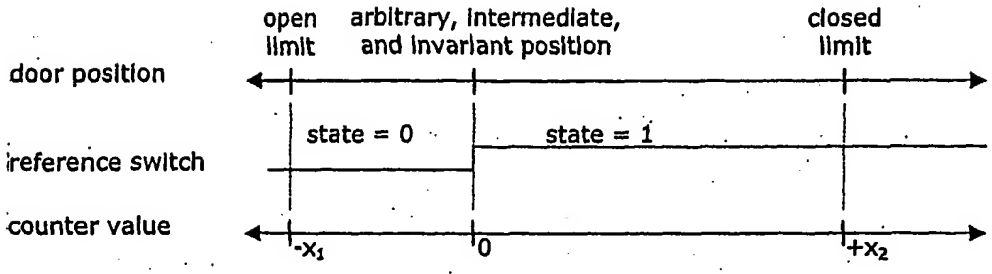
open limit
arbitrary, intermediate, and invariant position
closed limit
door position
state = 0
state = 1
reference switch
counter value
-x1
0
+x2

FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ03/00211

A.	CLASSIFICATION OF SUBJECT MATTER
Int. Cl. [7]:	H04Q 9/00, H04J 13/00
According to International Patent Classification (IPC) or to both national classification and IPC	

B.	FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)	
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT, USPTO (code, rolling, access)	

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6411199 B1 (Geiszler et al) 25 June 2002 Whole Document	
A	US 5949349 A (Farris et al) 7 September 1999 Whole Document	
A	GB 2275552 A (Rover Group Limited) 31 August 1994 Whole Document	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 November 2003	04 DEC 2003
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	R.H. STOPFORD Telephone No : (02) 6283 2177

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/NZ03/00211

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member
US	6411199	NONE
US	5949349	NONE
GB	2275552	NONE

END OF ANNEX